



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/763,795	01/22/2004	Mysore P. Divakar	112518.00003	7938

26707 7590 03/07/2005

QUARLES & BRADY LLP
RENAISSANCE ONE
TWO NORTH CENTRAL AVENUE
PHOENIX, AZ 85004-2391

EXAMINER

PAREKH, NITIN

ART UNIT	PAPER NUMBER
----------	--------------

2811

DATE MAILED: 03/07/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/763,795

Applicant(s)

DIVAKAR ET AL.

Examiner

Nitin Parekh

Art Unit

2811

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 16 February 2005.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-34 is/are pending in the application.
- 4a) Of the above claim(s) 20-34 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-19 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. _____.
 - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- ☒ Notice of References Cited (PTO-892)
- ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____
- ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____
- ☐ Notice of Informal Patent Application (PTO-152)
- ☐ Other: _____

DETAILED ACTION

Election/Restriction

1. Applicant's election of Group I, claims 1-19 without traverse in Paper No. 3 is acknowledged.

Claim Rejections - 35 USC § 102

2. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

3. Claims 1, 7, 9, 11, 12, 16 and 18 are rejected under 35 U.S.C. 102(b) as being anticipated by Ho et al. (US Pat. 6369455).

Regarding claims 1, 7, 9, 11, 12, 16 and 18, Ho et al. disclose a semiconductor device in a ball grid array (BGA) configuration (Fig. 8), the device comprising:

- a semiconductor die
- an encapsulant/thermally conductive overmolding compound (TCMC- see 210 in Fig. 7; Col. 6, line 34; Col. 1, lines 60-68) disposed on the semiconductor die, and
- a pin shaped/pin-fin heat dissipating piece/pin-fin heat sink (PFHS) mounted to/on a surface of the encapsulant/TCMC (see 800/801 in Fig. 8), wherein heat

generated by the semiconductor die is dissipated through the thermally

conductive overmolding compound to the PFHS, and

- the PFHS including a base (not numerically referenced- see the bottom portion of 800 in Fig. 8) with a plurality of pin shaped fins/pin-fins (801 in Fig. 8) extending from the base

(Fig. 8; Col. 6, lines 22-57; Col. 1-4).

Claim Rejections - 35 USC § 103

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

5. Claims 2-4 and 13-15 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ho et al. (US Pat. 6369455) in view of Yamashita et al. (US Pat. 2004/0145046).

Regarding claims 2 and 13, Ho et al. teach the entire structure as applied to claims 1 and 11 respectively above, except the semiconductor die being a power semiconductor device.

Yamashita et al. teach using conventional dice/components including heat generating/power components in a power device having a heat sink (see 701 in Fig. 7B; sections 0076-0078, 0100 and 0101).

It would have been obvious to a person of ordinary skill in the art at the time invention was made to incorporate the semiconductor die being the power semiconductor device as taught by Yamashita et al. so that the desired electrical/power requirements and functionality can be achieved in Ho et al's device.

Regarding claims 3, 4, 14 and 15, Ho et al. teach the entire structure as applied to claims 1 and 11 above, except the overmolding compound being made with a thermally conductive (TC) epoxy or having thermal in a range of 2-5 watts/meter-K respectively.

Yamashita et al. teach the power device having a thermally conductive and electrically insulating member/molding compound made of a thermosetting/epoxy resin having the TC in a range of 1-10 watts/meter-K to provide improved thermal dissipation and reduced stress (704 in Fig. 7B; see sections 0027-0035, 0077 and 0101).

It would have been obvious to a person of ordinary skill in the art at the time invention was made to incorporate the overmolding compound being made with the thermally conductive epoxy or having thermal in a range of 2-5 watts/meter-K as taught by Yamashita et al. so that the thermal dissipation can be improved and the stress can be reduced in Ho et al's device.

6. Claims 5 and 6 is rejected under 35 U.S.C. 103(a) as being unpatentable over Ho et al. (US Pat. 6369455) in view of Mostafazadeh et al. (US Pat. 5663593).

Regarding claim 5, Ho et al. teach the entire structure as applied to claim 1 above, except the device further including leadframe supporting the semiconductor die.

Mostafazadeh et al. teach a device having a conventional leadframe supporting a semiconductor die (see 114/112 and 120 in Fig. 7), wherein a plurality of wire bonds are coupled between the semiconductor die and the leadframe (see 130 in Fig. 7; Col. 2 and 3).

It would have been obvious to a person of ordinary skill in the art at the time invention was made to incorporate the leadframe supporting the semiconductor die and the plurality of wire bonds being coupled between the semiconductor die and the leadframe as taught by Mostafazadeh et al. so that the device processing can be simplified in Ho et al's device.

7. Claims 8 and 17 is rejected under 35 U.S.C. 103(a) as being unpatentable over Ho et al. (US Pat. 6369455) in view of Huang et al. (US Pat. 2002/0180035).

Regarding claims 8 and 17, Ho et al. teach the entire structure as applied to claims 1, 7, 11 and 16 above, except the base including scour lines between the pin-fins.

Huang et al. teach a device having a device/devices having a variety of configurations of heat spreader/heat sink-HS (see Fig. 1-7) where the devices comprise a plurality of devices each having respective HS (see 23/2 in Fig. 1 and 2E-2G). Furthermore, the devices have dicing/scour lines between the HS structures (see the cut along 232 in Fig. 2G and along the dotted lines in Fig. 2E and 2F) to facilitate the dicing and singulation of the devices and to provide the desired HS surface area for each device (sections 0027-0038).

It would have been obvious to a person of ordinary skill in the art at the time invention was made to incorporate the base including scour lines between the pin-fins as taught by Huang et al. so that the desired surface area for the HS can be achieved and the device processing/cycle time can be improved in Ho et al's device.

8. Claims 10 and 19 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ho et al. (US Pat. 6369455) in view of Davies et al. (US Pat. 5901041).

Regarding claims 10 and 19, Ho et al. teach the entire structure as applied to claims 1 and 11 above, except a heat slug being disposed above the semiconductor die without contacting the PFHS.

Davies et al. teach a device having a heat sink (HS) and a heat spreader/slug (see 42 and 18 respectively in Fig. 2 and 3) where a heat spreader slug (see 18 in Fig. 2 and 3) is disposed above the semiconductor die without contacting the HS to provide

Art Unit: 2811

efficient heat dissipation and improved reliability of conductive connections (Col. 4, lines 30-68).

It would have been obvious to a person of ordinary skill in the art at the time invention was made to incorporate the heat slug being disposed above the semiconductor die without contacting the PFHS as taught by Huang et al. so that the heat dissipation and reliability can be improved in Ho et al's device.


Any inquiry concerning this communication or earlier communications from the examiner should be directed to Nitin Parekh whose telephone number is 571-272-1663. The examiner can normally be reached on 09:00AM-05:30PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Eddie Lee can be reached on 571-272-1732. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9318.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-308-0956.

NP

03-02-05



NITIN PAREKH

PRIMARY EXAMINER

TECHNOLOGY CENTER 2800